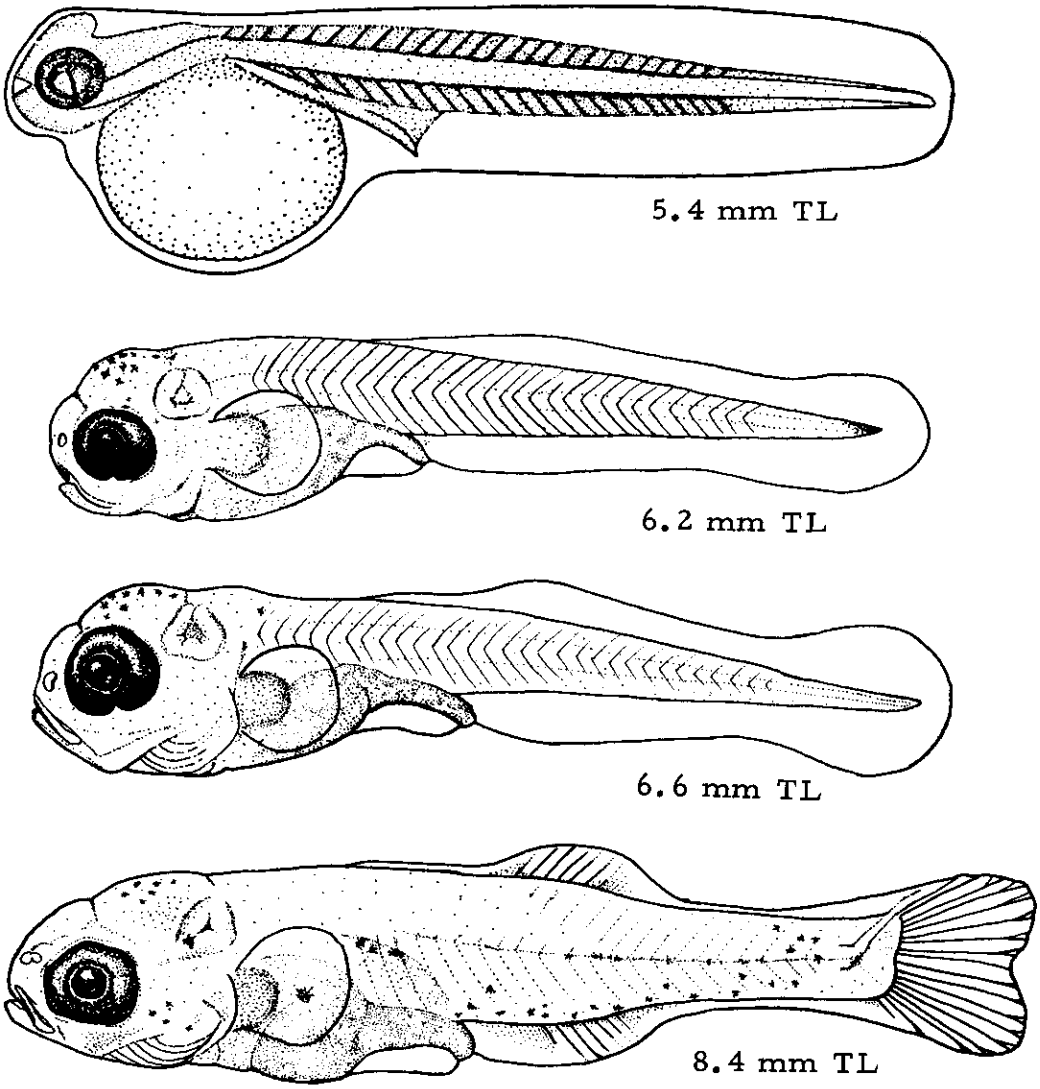


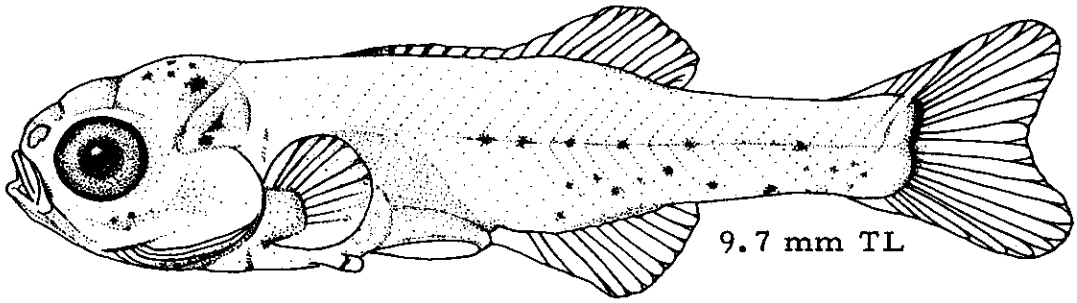
Spawning: Freshwater, nestbuilders in sluggish streams and ponds with no particular bottom preference.
Dates: May-July with peak in early June. Spawns in early spring along with or slightly later than M. dolomieui.
Temperature: 15.5-25 C; optimum 16-18 C.

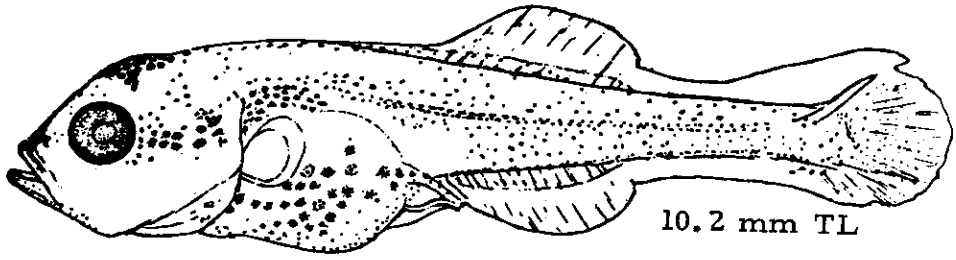
Eggs: Demersal, adhesive in nests.
Size: 1.4-1.8 mm.
Characteristics: Spherical with a thick membrane; oil globule single and large.

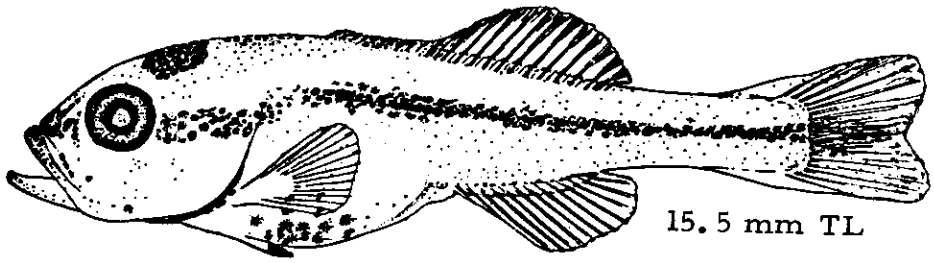
Larvae: Hatching size: Average 3.5 mm (2.7-4.3 mm) TL.

Characteristics: Myomeres 11 + 19 in yolk-sac larvae. Part of yolk sac may be retained up to 7 mm. Larvae not as densely pigmented as M. dolomieui; pigmentation restricted to dorsal surface of head, ventral and lateral surfaces in area of gut coils, on upper lip, and along lateral line. The gut is massively coiled by 8 mm. By 10 mm, larvae deep bodied and lateral band evident.

Micropterus salmoides - largemouth bass





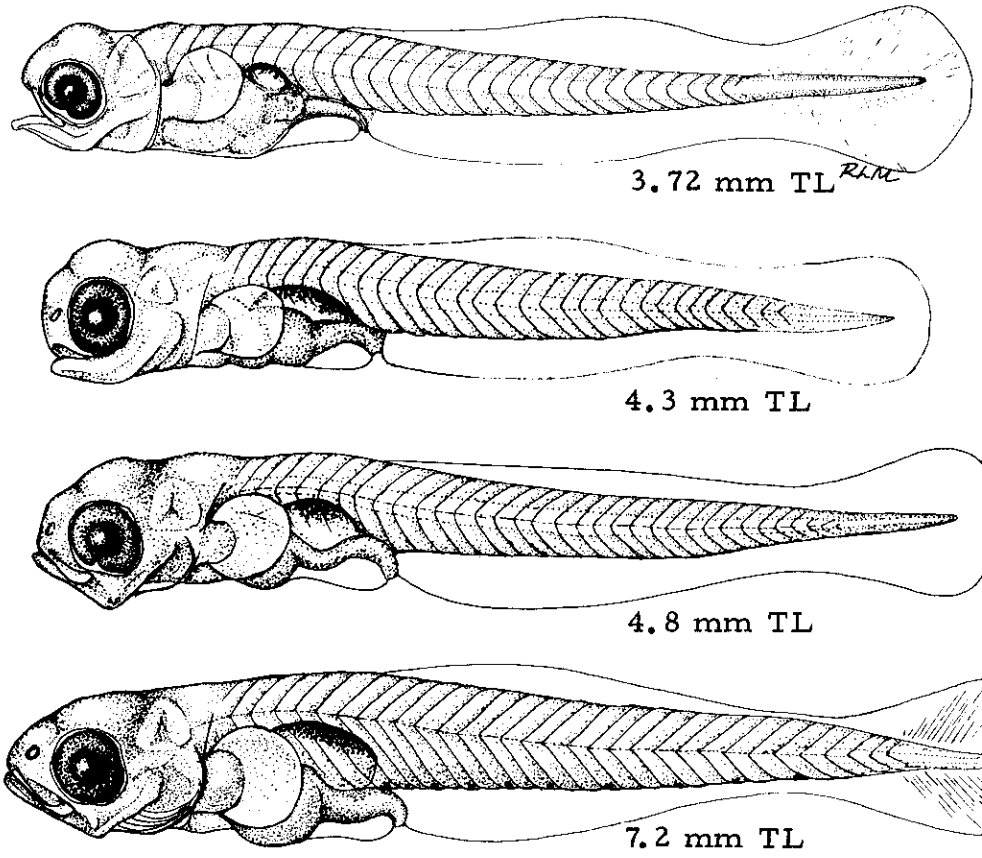


Juveniles: Maxillary reaching to or beyond posterior margin of eye; easily distinguished from most other centrachids by heavier pigmentation on top of head, lateral band and a less compressed body; more stocky and slightly larger than similar stages of L. megalotis which they most resemble. Distinguished from M. dolomieui by the dark lateral band and larger mouth.

Adults: D. X, 12-13; A. III, 11; mouth large, lower jaw projecting; gill rakers short (7 on lower limbs); lateral line slightly arched anteriorly.

References: Breder and Rosen, 1966; Hildebrand and Schroeder, 1928; Mansueti, 1964; Meyer, 1970; Scott and Crossman, 1973; Snyder, 1971; Taber, 1969.

Illustrations: Larvae, 5.4, 10.2 and 15.5 mm, Meyer, 1970; larvae 6.2, 6.6, 8.4 and 9.7 redrawn after Taber, 1969.



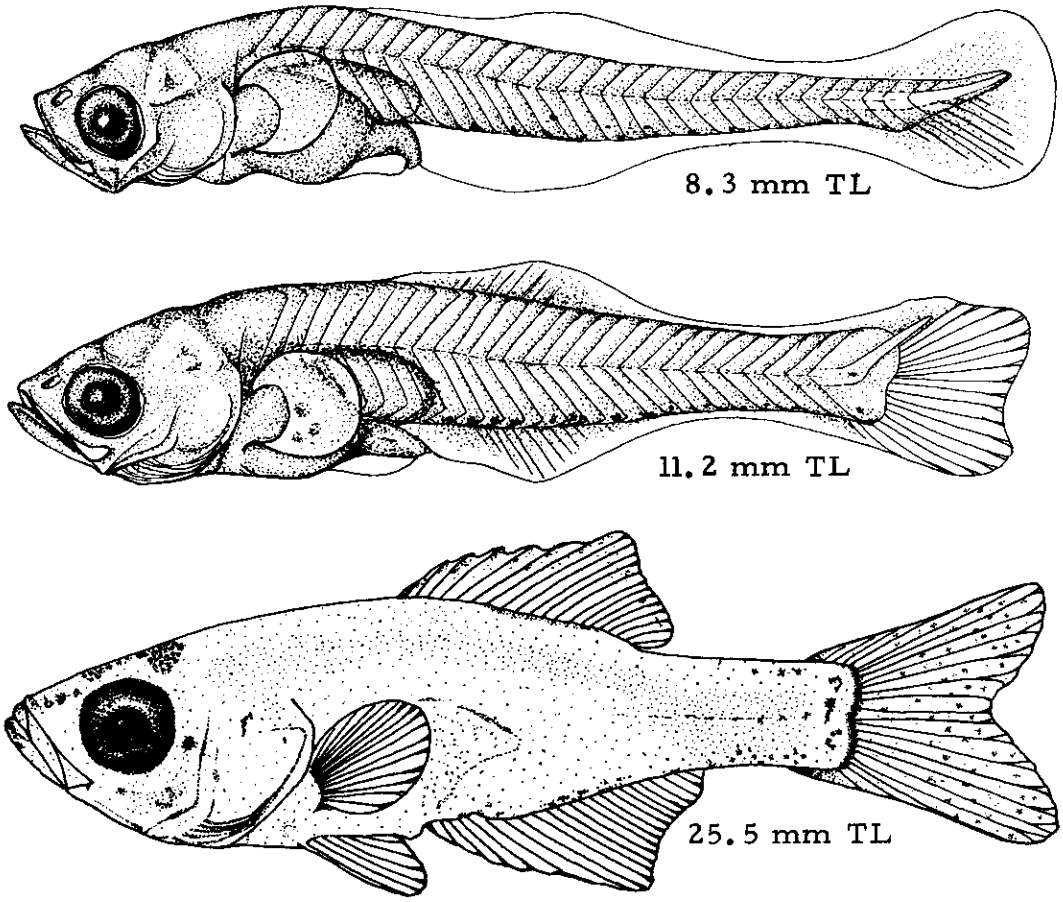
Spawning: Freshwater, nestbuilders in depths from 2-20 ft. with no particular bottom preference.
Dates: Late May-August, maximal spawning in June.
Temperatures: 16-28 C; optimum 24-27 C.

Eggs: Demersal, in nests or attached (usually to plants).
Size: Unknown.

Larvae: Hatching size: Very small (rarely over 3 mm); smaller at hatching than Lepomis spp.

Characteristics: Little pigmentation except for several melanophores on surface of air bladder. Lacks anal melanophore characteristic of Lepomis spp. A coil forms in gut at, or prior to, yolk sac absorption, in contrast to Lepomis spp. where the first coil does not form until 4.5-6.0 mm. Pomoxis spp. have the shortest gut of any Potomac centrarchid, preanal length always less than postanal length. The larvae are smaller, have a more laterally compressed body, sparser pigmentation and a less massive gut than Micropterus spp. The gut does not extend conspicuously beyond the gas bladder (as does the gut of Lepomis spp.). Pigmentation is sparse into the juvenile stage. There are currently no reliable characteristics for separating the two species of Pomoxis at sizes less than 6 mm. After 6 mm, separation is possible using myomere counts (ca. 30 in P. annularis, ca. 32 in P. nigromaculatus), and by the general lack of pigmentation on P. annularis.

Pomoxis annularis - white crappie



Juveniles: Five to seven dorsal spines (usually six or seven) while P. nigromaculatus has seven to eight. Dorsal spine counts with considerable local variations so they should be used with caution. Base of dorsal fin shorter than the distance from its origin to the posterior orbital rim, while in P. nigromaculatus the dorsal is equal to or greater than this distance. Separated from Micropterus spp. and Lepomis spp. in that the spineous dorsal fin originates above or only slightly anterior to the vent.

Adults: D. V-VII, 13-15; A. VI, 16-18. Dorsal fin length as described for juveniles.

References: Eddy, 1957; Scott and Crossman, 1973; Siefert, 1969; Snyder, 1971; Taber, 1969.

Illustrations: Larva, 3.72 mm, original drawing by R. Lynn Moran; remaining illustrations redrawn from Taber, 1969.

Spawning: Freshwater, nestbuilders in shallow (1-2 ft.) areas with vegetation.
Dates: Spring to mid-summer.
Temperature: 16-28 C.

Eggs: Demersal; in nests or attached (usually to plants).
Size: Unknown.

Larvae: Hatching size: Very small, rarely over 3 mm.

Characteristics: Virtually indistinguishable from P. annularis until 6 mm, when myomere counts may be used (ca. 32 myomeres vs ca. 30 in P. annularis). Postlarval specimens (> 9 mm) may show some scattered pigmentation while P. annularis at this stage will not. Separated from Micropterus spp. on the basis of a more laterally compressed body shape and less pigmentation. Separated from Lepomis spp. on the lack of an anal melanophore and the size at which the first gut coil forms (< 3 mm, while in Lepomis spp. 4.5-7 mm).

Juveniles: Seven to eight dorsal spines as opposed to five to seven (usually six or seven) in P. annularis. Base of dorsal fin equal to or greater than the distance from its origin to the posterior orbital rim, while in P. annularis the dorsal is shorter than this distance. Separated from Micropterus spp. and Lepomis spp. in that the dorsal originates above or only slightly anterior to the anus.

Adults: D. VII-VIII, 14-16; A. VI, 16-18. Dorsal fin length as described for juveniles.

References: Eddy, 1957; Scott and Crossman, 1973; Siefert, 1969; Taber, 1969.

By

Fred C. Rohde[1]

Four percids are found in the lower Potomac River region: swamp darter, Etheostoma fusiforme; tessellated darter, E. olmstedi; glassy darter, E. vitreum; and yellow perch, Perca flavescens. The listing of tessellated darter instead of the johnny darter, E. nigrum, is based on Cole (1967, 1971) who presented evidence that E. olmstedi is a valid species and is found east of the Appalachian Divide while E. nigrum, with few exceptions, is found in the Mississippi drainage to the west of the Appalachians. Darters are found in shallow riffle areas, while the yellow perch is distributed throughout the region, especially in deeper waters.

Of the four species, only yellow perch are found with any regularity in low salinity waters. Yellow perch tolerate salinities up to 12 ppt (Lippson, 1973). The tessellated darter has been taken in waters up to 13 ppt (Musick, 1972), but prefers freshwater. The remaining two species are strictly freshwater residents and will be found in shallow streams tributary to the Potomac. All four species apparently spawn in tidal freshwaters.

Of all the demersal attached eggs in tidal freshwaters, only percid, white perch and certain centrarchid eggs contain a distinctive single large oil globule. Darter eggs are ovoid, broadly attached with thin smooth egg capsules, diameter ca. 1.5 mm; white perch eggs are spherical with thick egg capsules, and distinct attachment discs, diameter ca. 1 mm; centrarchid eggs are spherical, usually found only in nests and generally less than 1.5 mm in diameter.

Yellow perch eggs, confused with no other, are laid in long, gelatinous strands that attach to fallen limbs and other debris. After hatching, larvae migrate downstream, and are frequently collected with larvae of the striped bass and white perch. Darters attach their eggs singly to rocks and aquatic plants, and after hatching, the larvae remain close to the spawning areas. Percid larvae are distinguished by their large pectoral fins and the position of the vent slightly caudal to mid-body. In centrarchids, the vent is located more anteriorly, while in catostomids it is further posterior. The large oil globule at the anterior of the yolk sac is also a diagnostic character. Some post yolk-sac darters bear a resemblance to Fundulus diaphanus larvae.

Because of the late winter early spring spawning season of yellow perch, their larvae will be taken the earliest of the percids. Morphologically, they differ from darters by larger body size at fin development, relatively smaller size of pectoral fins, and terminal position of mouth. In addition, the eyes in darters, when viewed dorsally, are brought almost together on top of the head, and pelvic buds form before development of other fins rather than after, as occurs in yellow perch. Larvae and juveniles of yellow perch are similar to those of the temperate basses but can be differentiated quickly by myomere count.

Previous to fin formation, differentiation among darter species is difficult and reliance must be placed on general body shape and proportions. This is, at best, tenuous. After fin formation, darter larvae can be differentiated from each other by anal counts, body shape, and morphology of the premaxillary (see key).

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Key to Adult and Juvenile Percidae Found in the Potomac River Region

1a. Branchiostegal rays 7 (rarely 8), pectoral fins normal size, maxilla extending to middle of eye, preopercle strongly serrate, pseudobranchiae well-developed; medium size fish -- Perca flavescens.

1b. Branchiostegal rays usually 6 (sometimes 5 or 7), pectoral fins larger than normal, mouth small, maxilla not extending to middle of eye, preopercle with totally smooth edge, pseudobranchiae rudimentary or lacking; small fishes (2).

2a. Abdominal region naked, body elongate and translucent, back naked from middle of first dorsal forward, anal spines II -- Etheostoma vitreum.

2b. Abdominal region not naked, body not extremely elongate or translucent, back either entirely scaled or naked only in front of first dorsal fin -- (3).

3a. Premaxillaries protractile, separated from snout by a groove; lateral line complete; anal spine I -- Etheostoma olmstedi.

3b. Premaxillaries non-protractile, bound to snout by a frenum; lateral line incomplete; anal spines II -- Etheostoma fusiforme.

Etheostoma fusiforme - swamp darter

Adult swamp darters are found in tidal freshwaters in Delaware (Wang, 1974 Workshop) but whether spawning occurs in tidal waters is unknown.

Spawning: Freshwater, sluggish tributary streams of Potomac River, usually with bottoms of mud or detritus.
Dates: April-May.

Eggs: Demersal, attached. Eggs deposited singly on plants.
Size: No information available.
Characteristics: No information available, assume similar to other darters.

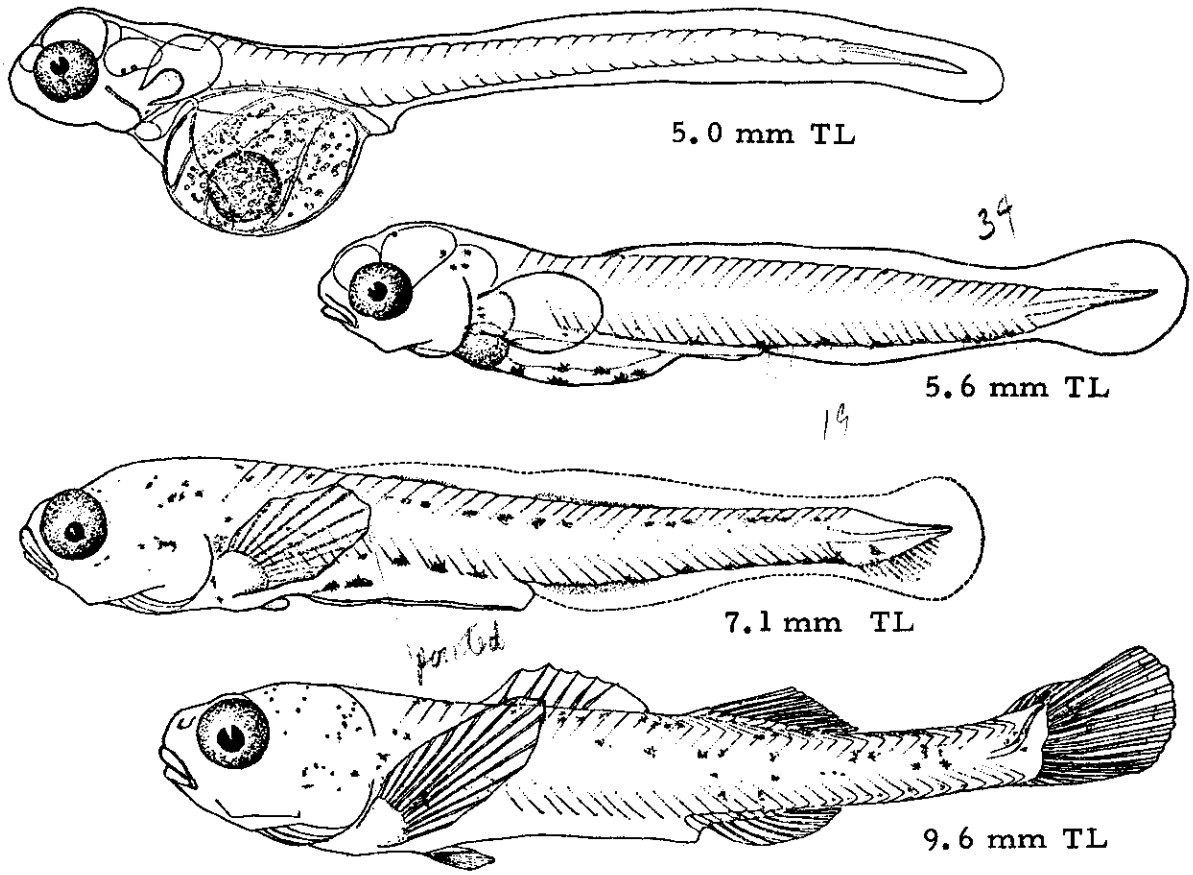
Larvae: Hatching size: No information available.

Characteristics: No information available.

Juveniles: Nonprotractile premaxillaries, black basi-caudal spot just below center of caudal base, faint dorsal and ventral basi-caudal spots. Separated from E. olmstedi by presence of two anal spines and from E. vitreum by presence of frenum.

Adults: D. VIII-XIII, 8-13; A. II, 5-10; P. 12-15; lateral line scales 40-63, lateral line incomplete.

References: Collette, 1962.



In the Chesapeake drainage north of the Rappahannock River the tessellated darter is indigent to most Coastal Plain streams (Cole, 1967) including the Potomac. It is assumed here that past records of E. nigrum in the Potomac are actually E. olmstedi.

Spawning: Fresh and tidal freshwaters. Eggs usually deposited under rocks and similar materials.
Dates: Late April-June.

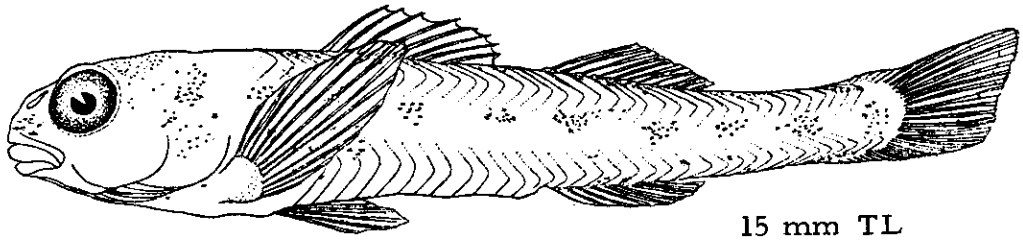
Eggs: Demersal, attached and aggregated.
Size: 1.13 mm-1.60 mm.
Characteristics: Spherical, yolk amber, one large dark amber oil globule.

Larvae: Hatching size: No direct information available, assume approximately 5 mm as in E. nigrum.

Characteristics: No direct information available. Illustrations of larval and juvenile E. nigrum from Fish (1932), are reproduced for reference. E. olmstedi larvae would be of like morphology and appearance. Compared to E. vitreum snout more blunt, head and body more robust; by 10 mm, anal count established and identification possible.

Juveniles: Series of markings along lateral position of body, resemble adults; protractile premaxillaries. Separated from E. vitreum and E. fusiforme by anal spine count (one vs. two).

Etheostoma olmstedi - tessellated darter

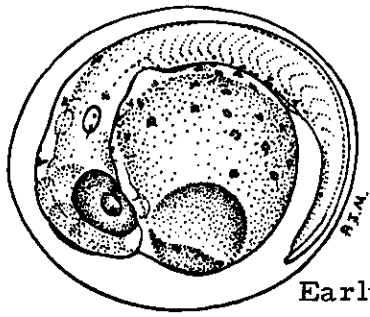


15 mm TL

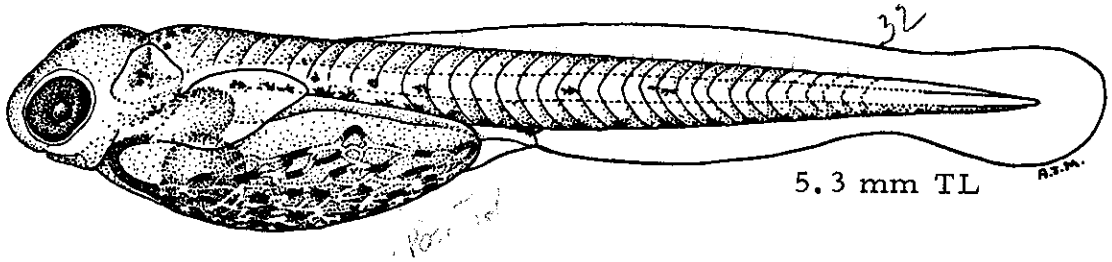
Adults: D. VIII-IX, 11-17; A. I, 6-10; P. 11-15; lateral line scales 40-64, lateral line complete.

References: Atz, 1940; Cole, 1967; Tsai, 1972; Fish, 1932.

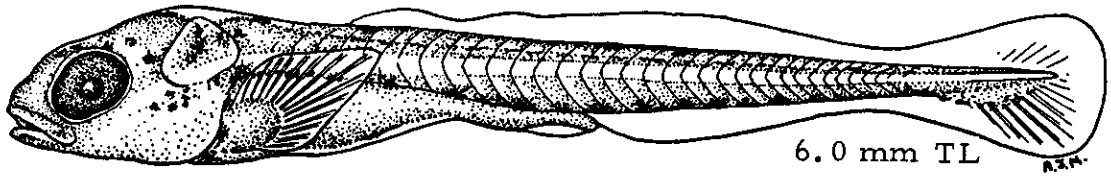
Illustrations: Fish, 1932.



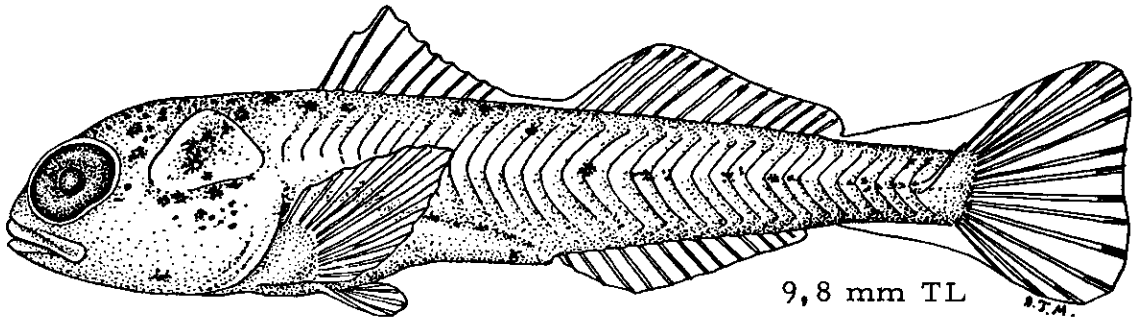
Early embryo



5.3 mm TL



6.0 mm TL



9.8 mm TL

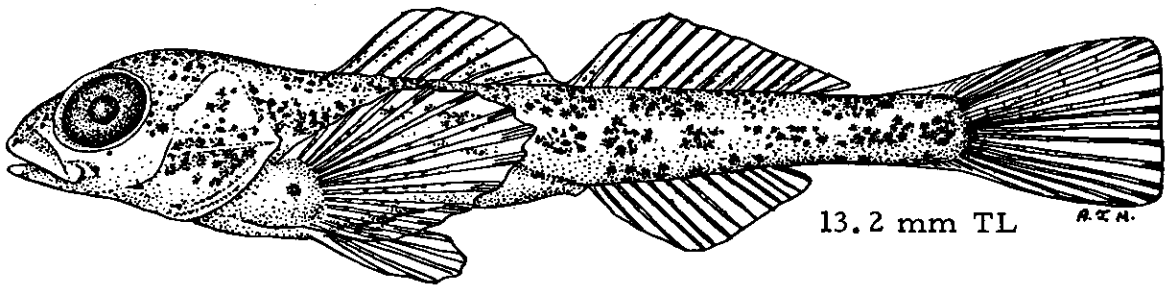
Spawning: Shallow fresh and tidal freshwater; usually on sandy bottoms. Eggs deposited on rocks, logs, in crevices, etc. Dates: Mid-March through April.

Eggs: Demersal, attached and aggregated. Apparently adhesive until attached, then only adhesive in area of attachment. Size: 1.42 mm-1.70 mm; yolk 1.0 mm-1.3 mm; oil globule 0.5 mm. Characteristics: Ovoid, irregular, clear membrane, yolk amber, with single dark amber oil globule.

Larvae: Hatching size: Ca. 4.75 mm TL.

Characteristics: Yolk-sac larvae with large pectorals and distinct intermediate bands of melanophores along perivitelline vessels. Pigment heavy on head, posterior dorsal line of chromatophores. Myomeres, total 28-38 (average 34), preanal 11-15 (average 13), postanal 16-25 (average 21).

Etheostoma vitreum - glassy darter



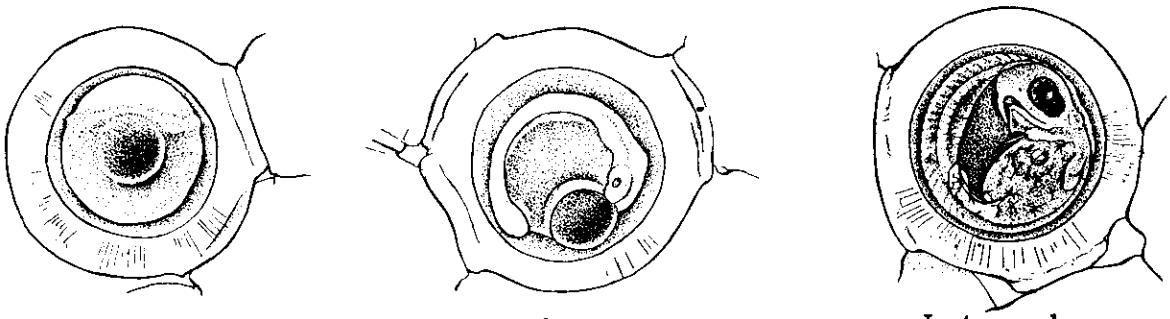
Yolk absorbed by 6.1 mm. With growth, eyes migrate dorsally, snout elongates, distinctive yolk pigmentation disappears but melanophores develop along mid-ventral line. Myomeres: total 33-37 (avg. 35), preanal 11-16 (avg. 14), postanal 20-23 (avg. 21). By ca. 9.0 mm, adult fin counts attained.

Juveniles: Approximately 13 mm and above. Notochord highly pigmented; scales formed. Separated from E. fusiforme by protractile premaxillaries and from E. olmstedi by anal spine count (2 vs. 1).

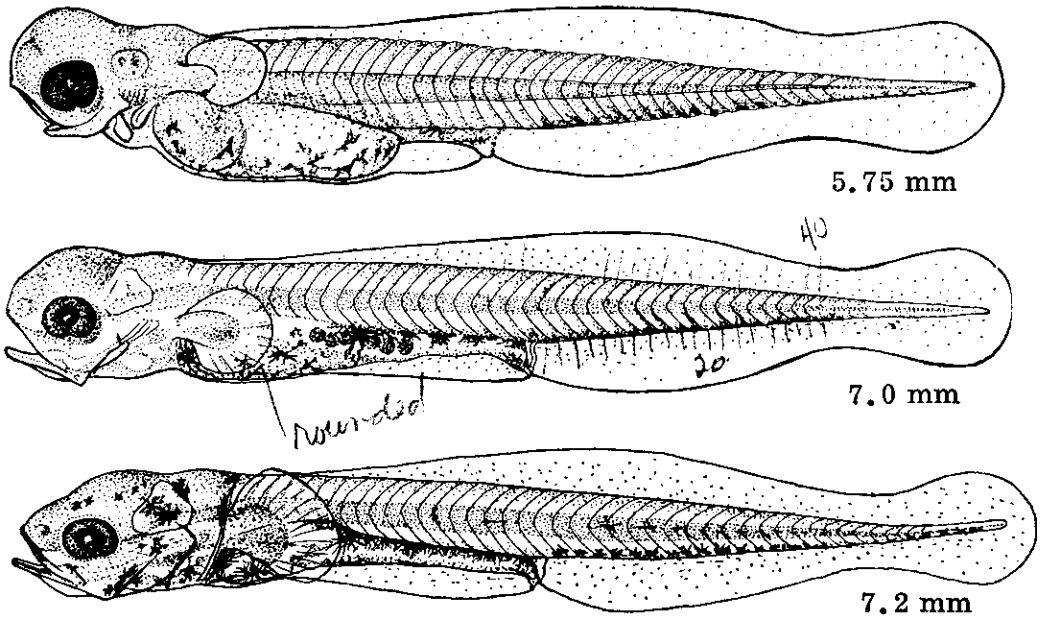
Adults: D. VII-VIII, 14-15; A. II, 13.

References: Kennedy, 1965; Winn and Picciolo, 1960.

Illustrations: Kennedy, 1965.



Gastrula | Early embryo | Late embryo

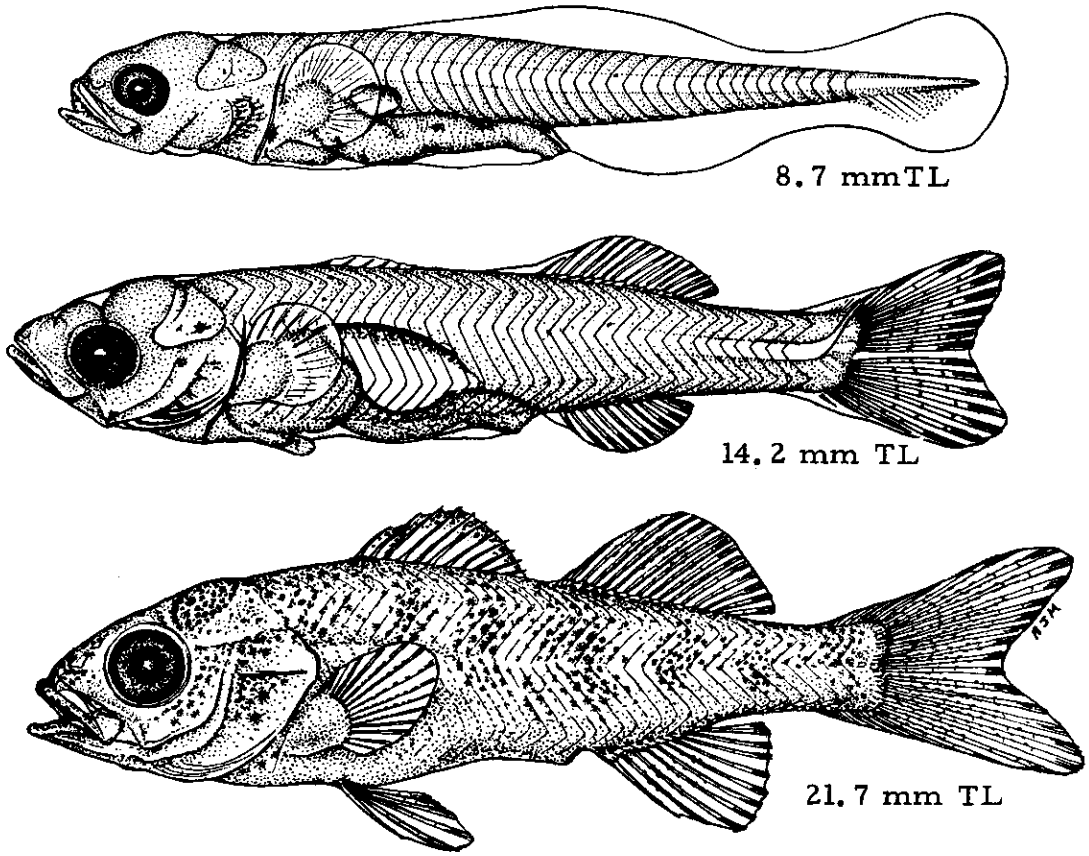


The yellow perch is one of the more abundant species in the Potomac River, spawning in many tributaries. Larvae are commonly collected both in the mainstream and within the tributaries, and are among the easiest to identify.

Spawning: Fresh and tidal freshwater, frequently in shallow water (two or three feet).
Dates: Late February, March into early April, spawning period usually of short duration -- i.e., 2 weeks in and out of a spawning ground.

Eggs: Eggs are laid in a distinctive strand with little possibility of confusing them with any other species. Eggs are extruded in long "accordian folds" about 1 1/2 inch thick. Strands are slightly heavier than water and float in the current until they become entangled in debris.
Size: Highly variable, 1.7-4.5 mm. Yolk 1.28 mm (range 1.16-1.58), oil globule 0.64 mm (range 0.49-0.92).

Perca flavescens - yellow perch



Characteristics: Thick elastic capsule with radial striations, single large oil globule; incubation long. (Laboratory reared: 27 days at 8.5-12 C). At hatching, embryo well advanced, mouth functioning and yolk half absorbed.

Larvae: Hatching size: 5.5-6.0 mm TL.

Characteristics: At hatching, head separate from yolk; large oil globule in anterior of yolk, dorsal finfold continuous, pectorals contain some ray elements, eyes darkly pigmented, series of 15 to 20 spots along mid-ventral line of tail and over yolk, vent position just slightly anterior to mid-body length. Teeth evident as early as 7 mm.

General appearance remarkably like white perch, Morone americana, and striped bass, Morone saxatilis, but easily separated by total myomere count. In yellow perch 34-40 myomeres (avg. 38), white perch and striped bass 23-26 myomeres (avg. 25). By ca. 20 mm, adult counts attained (with exception of anal fin), vertical pigmented bands evident along body. Between 20-30 mm, anal spine transformation complete; anal formula changed from I, 6-10 to II, 7-8 (occasionally, 6-9).

Juveniles: Changes occur in meristics and pigmentation until adult stage. Before transformation of first anal soft-ray into a spine at ca. 25 mm, anal count is normally I, 8; after 25 mm it is normally II, 7. Separated from darters by greater size at fin development, smaller pectoral fins and terminal mouth position.

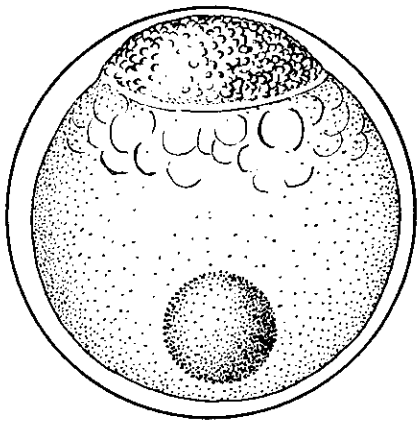
yp 38 - 2640

Adults: D. XII, I, 14-15; A. II, 6-9 (commonly 7, 8); P. 14-15.

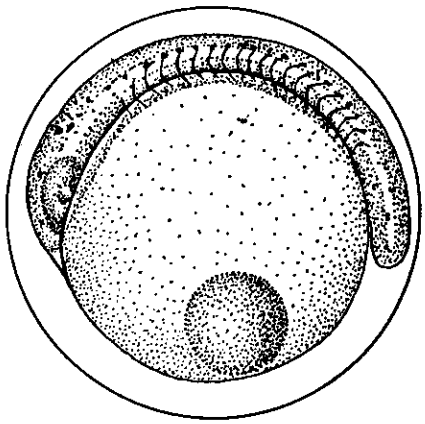
References: Mansueti, 1964; Fish, 1932.

Illustrations: Mansueti, 1964.

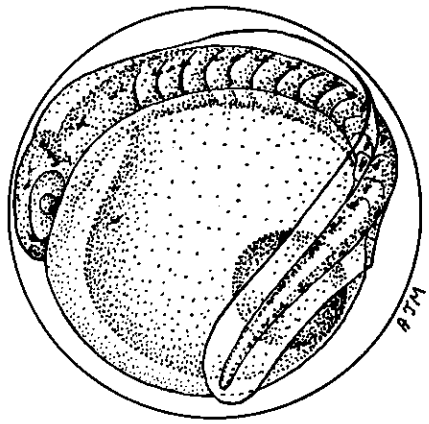
Pomatomidae - bluefishes
Pomatomus saltatrix - bluefish



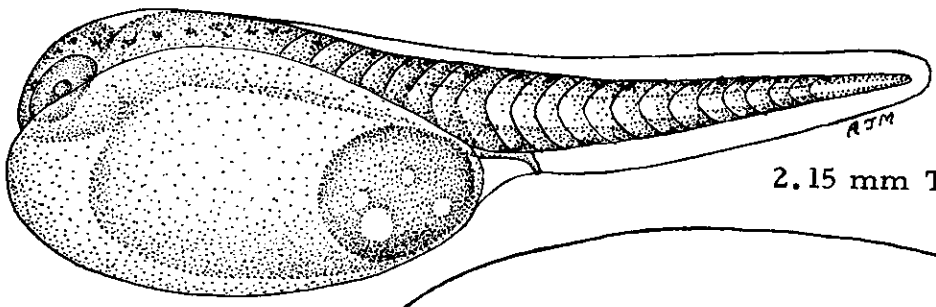
Morula



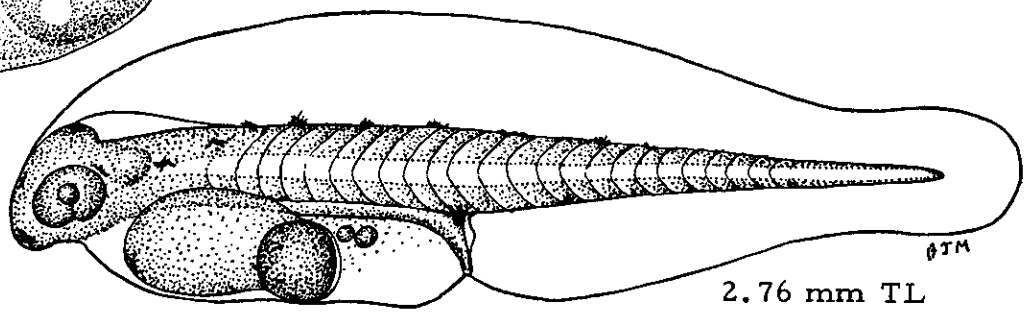
Early embryo



Late embryo



2.15 mm TL



2.76 mm TL

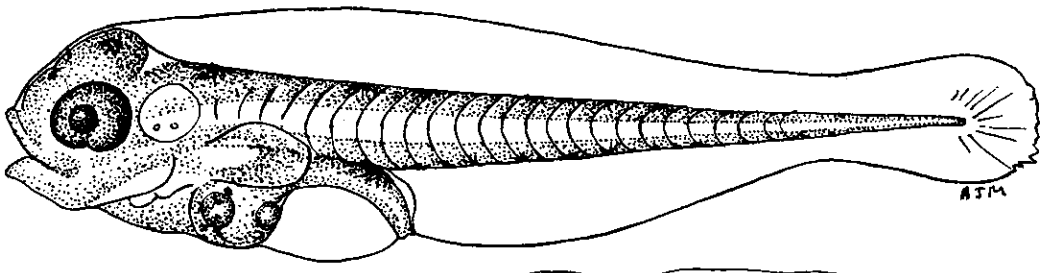
Bluefish are essentially offshore ocean spawners, although recently hatched larvae have been collected within the mouth of Chesapeake Bay (Pearson, 1950). Eggs and early larvae should not be found as far within the estuary as the Potomac River. On the other hand, late larvae and juveniles migrate into Chesapeake Bay and into the Potomac on occasion.

Spawning: Offshore, principally on outer half of continental shelf.
Dates: Early summer, June to August with peak in July.

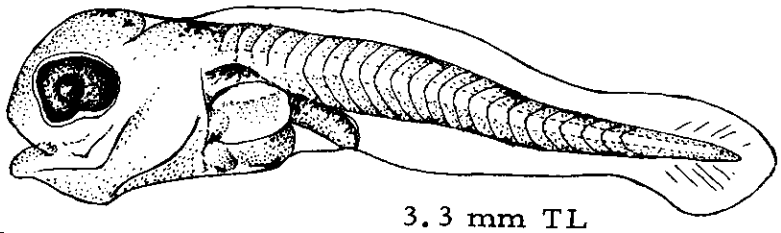
Eggs: Pelagic, highly buoyant.
Size: 0.90-1.20 mm.
Characteristics: Egg capsule transparent, thin but tough; single large oil globule 0.22-0.30 mm diameter; perivitelline space ca. 1/6 egg radius; embryonic tail does not extend fully around yolk.

Larvae: Hatching size: 2.0-2.4 mm TL

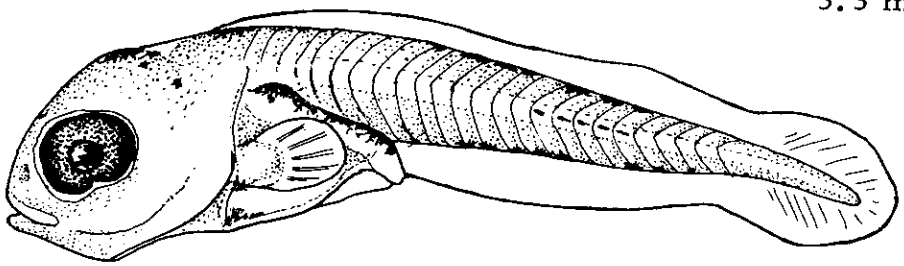
Characteristics: At hatching, yolk-sac more than half body length and oil globule located at posterior of yolk. Development rapid and by ca. 4 mm yolk-sac absorbed, larvae more robust, head large, teeth developed, and myomere count 24.



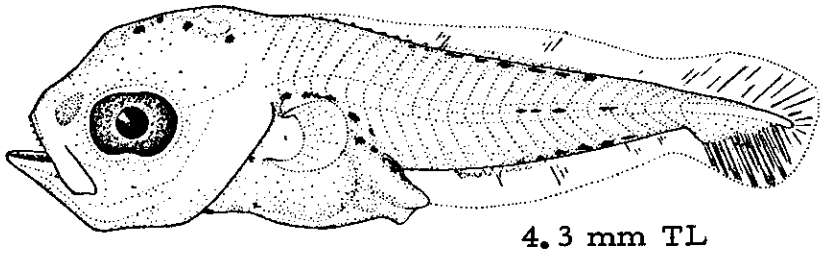
3.08 mm TL



3.3 mm TL



4.0 mm TL



4.3 mm TL

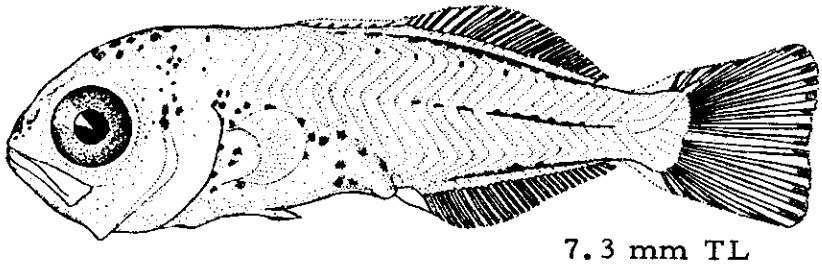
Melanophore pattern of early larvae (ca. 3-7 mm) characteristic: few large stellate melanophores over head, one at nape, few small ones over snout and upper jaw, heavy concentration over dorsal surface of air bladder and hind gut, one at base of pectoral fins, distinct mid-dorsal and mid-ventral rows, and mid-lateral pigment bars evident by 4.0 mm.

With growth, head malanophores increase in number and decrease in size spreading over head region; mid-dorsal and mid-ventral rows coalesce and form heavy double lines of pigment along bases of dorsal and anal fins. The lateral bars increase in number forming a distinct lateral line. In later larvae, entire body peppered with small melanophores.

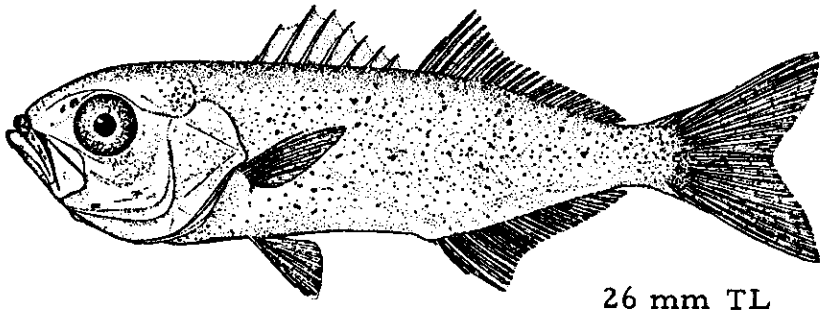
Incipient fin rays evident by ca. 6.0 mm, countable by ca. 8.0 mm, and fin development complete by ca. 13-14 mm.

Bluefish larvae are similar in appearance to butterfish, P. triacanthus, larvae but can be separated on basis of myomere counts (24 vs. 30) and pigmentation. Although the large head and short guts of bluefish larvae are somewhat similar to sciaenid and black sea bass, C. striata, the differences in shape of head and size and angle of mouth are distinct. For separation of bluefish larvae from other marine forms not encountered in the Potomac see Norcross, et al. (1974).

Pomatomus saltatrix - bluefish



7.3 mm TL



26 mm TL

Juveniles: Adult appearance and full fin counts attained at least by 13-14 mm, head proportionally larger than in adults, preopercle serrate, caudal peduncle stout, anal fin equal to second dorsal fin.

Adults: D. VII-IX, 23-28; A. II-III, 24-29 (anal spines minute); abdominal vertebrae 11, caudal vertebrae 15; scales 95-105; gill rakers; lower limb of first arch 11-14.

References: Deuel, et al., 1966; Pearson, 1950; Hildebrand and Schroeder, 1928; Miller and Jorgensen, 1973; Norcross, et al., 1974; Lund, 1961.

Illustrations: Eggs, 2.15, 2.76, and 3.08 mm larvae, Deuel, et al., 1966; 2.2 and 4.0 mm larvae, redrawn after Norcross, et al., 1974; 4.3 and 7.3 mm larvae, juvenile, Pearson, 1950.

The drum family is represented in the Chesapeake Bay area by nine species of seven genera: silver perch, Bairdiella chrysura; spotted seatrout, Cynoscion nebulosus; weakfish, Cynoscion regalis; spot, Leiostomus xanthurus; southern kingfish, Menticirrhus americanus; northern kingfish, Menticirrhus saxatilis; Atlantic croaker, Micropogon undulatus; black drum, Pogonias cromis; and red drum, Sciaenops ocellata.

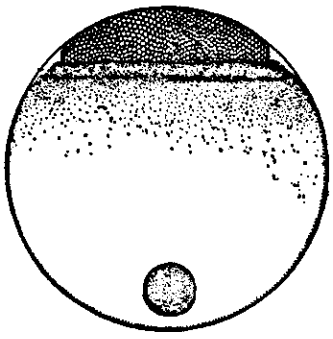
Since all nine species listed spawn in the lower bay or ocean, eggs will not be taken in the Potomac River. Larvae which hatch offshore move upstream with advanced development and may be found in the Potomac as late larvae or juveniles, easily recognizable at these stages.

Generally, weakfish are taken in the Potomac River at smaller sizes than specimens of the Atlantic croaker or spot, which tend to stay offshore and migrate inshore only at older stages (ca. 9 mm).

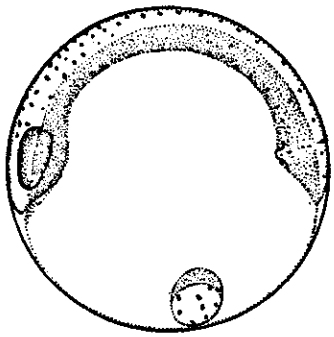
The identification of eggs within the drum family is difficult because of morphological similarities, overlapping spawning seasons of the adults, and bimodal egg diameter measurements from single collections. No single characteristic is unique in identifying drum eggs but when all characteristics are taken collectively, sciaenid eggs can be set apart as a family. All known eggs are pelagic and relatively small (from 0.66 to 1.3 mm in diameter), usually contain multiple oil globules which coalesce with development, and become pigmented in later stages. Other species which produce eggs similar to those of the drums include pigfish, Orthopristes chrysopterus (similar to eggs of the silver perch); and Atlantic mackerel, Scomber scombrus; scup, Stenotomus chrysops; and butterfish, Peprilus triacanthus (which resemble eggs of the weakfish).

Drum larvae are easily recognizable as a group by a short, deep and robust head; body which usually tapers sharply to a point posteriorly; short gut; large oblique mouth; and large eye. Prolarvae mature rapidly without much increase in total length. In most species, yolk is absorbed within 1 mm or less from hatching size (see species for individual descriptions). A table follows summarizing spawning and comparative life-history information. The keys presented in Hildebrand and Cable (1934) for the identification of eggs, larvae, and young of 13 sciaenid species are useful additional references.

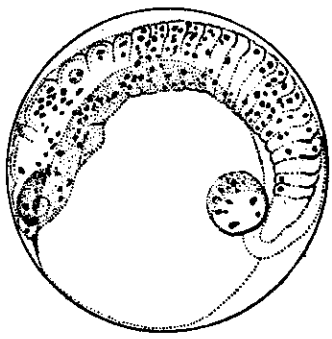
	SILVER PERCH *Bairdiella chrysura*	SPOTTED SEATROUT *Cynoscion nebulosus*	WEAKFISH *Cynoscion regalis*	SPOT *Leiostomus xanthurus*	SOUTHERN KINGFISH *Menticirrhus americanus*	NORTHERN KINGFISH *Menticirrhus saxatilis*	ATLANTIC CROAKER *Micropogon undulatus*	BLACK DRUM *Pogonias cromis*	RED DRUM *Sciaenops ocellata*
Spawning Date	Mid-May to early Aug.	May-July (possibly in Aug.)	May-Sept.	Dec.-April	May-Aug.	May-Aug.	Aug.-Dec.	Feb.-May	Sept.-Oct. (probable)
Spawning Location	Lower Bay and off-shore along coast	Lower Bay and off-shore along coast	Lower Bay and off-shore along coast	Lower Bay and off-shore along coast	Lower Bay and off-shore along coast	Lower Bay and off-shore along coast	Lower Bay and off-shore along coast	Lower Bay and off-shore along coast	Lower Bay and off-shore along coast
Eggs:									
Size and location	0.66-0.88 mm	Eggs unknown	0.8-1.3 mm	Eggs unknown	Eggs unknown	0.75-0.92 mm	Eggs unknown	0.81-1.08 mm	Eggs unknown
No. of oil globules	1-2		1-6			1-18 (usually 12-15)		1-6 (usually 2-4)	
Avg. dia. of oil globules after coalescence	.18 mm		.22 mm			Undetermined		0.25 mm	
Prolarvae:									
Hatching length (TL)	1.5-1.8 mm	Unknown	1.5-1.75 mm	Ca. 1.5 mm	Ca. 1.7 mm	2.0-2.5 mm	Ca. 1.5 mm	Ca. 1.9-2.4 mm	Unknown
Length at absorption of yolk (TL)	2.5-2.8 mm	Unknown	Ca. 1.8 mm	Ca. 1.5 mm	Unknown	(<2.8 mm on ca. 4th day after hatching	Unknown	Before 5-6 mm	Ca. 7.0 mm
Larvae:									
Distinguishing pigmentation	Two dark vertical bands: one behind head and one ca. 2/3 distance from vent to tail.	Mid-lateral and ventral line on caudal peduncle, spot anterior to vent (not as prominent as in C. regalis).	Ventral line on caudal peduncle, prominent spots anterior to vent; at midanal fin base, and later on dorsum above anal spot.	Dark spot internally on anterior of gut between cleitha row along ventral portion of trunk, ventral spots in diamond pattern.	Dark melanophores around mouth, patch on roof of mouth visible externally.	Few melanophores on nape, mid-lateral and mid-ventral rows, patch on roof of mouth visible externally.	Prominent spot at vent; melanophores mid-ventrally on abdominal and trunk area; lacks dorso-lateral pigmentation.	Prominent melanophores on middle of anal fin base.	Prominent melanophore on posterior anal fin base.
Shape of caudal fin	Rounded	Paddlelike becoming asymmetrically elongate (longest rays in lower half).	Paddlelike becoming centrally elongate in early stages.	Paddlelike, becoming square.	Squarely rounded becoming centrally elongate	Squarely rounded becoming asymmetrically elongate (longest rays in lower half)	Spatulate, becoming asymmetrically (longest rays in lower half)	Squarely rounded becoming square with development	Symmetrically elongate (longest rays in center)
Juveniles:									
Total length at full fin complement	Ca. 10.0-12.0 mm	Ca. 7.0-8.0 mm	Ca. 8.0-8.5 mm	Ca. 11.0-12.0 mm	Ca. 7.0-8.0 mm	Ca. 10.0 mm	Ca. 11.0 mm	8.0 mm	Unknown
Distinguishing pigmentation	Silvery grey over most of body	Dark longitudinal bands along body	Dusky vertical bands along body	Light; blotches along mid-lateral line and light saddles over back	Dark or dusky pigmentation all over except ventrum	Dark pigmentation over all of body	Spots or (short dusky) bands along back and along lateral line	Dark bars from nape of neck to tail - no ventral pigmentation	Dark vertical band or spot at base of caudal fin and numerous dark patches along sides
Shape of caudal fin	Squarely rounded	Asymmetrically elongate (longest rays in lower half)	Symmetrically elongate (longest rays in center)	Square to slightly concave	Asymmetrically elongate (longest rays in center)	Asymmetrically elongate (longest rays in lower half)	Asymmetrically elongate (longest rays in center)	Square to slightly concave	Square
Barbels present	No	No	No	No (pores present under chin)	Yes (one on chin)	Yes (one on chin)	Yes (numerous)	Yes (numerous)	No
Adult Meristics:									
Dorsal fin	X-XI, I or II, 19-21 (rarely 22 or 23)	X (rarely XI), I, 24-27	X-XI, I, 24-29	X-XI, I, 29-34	X, I, 24-27	X, I, 23-26 (rarely 27)	X, I, 28-29	X, I, 20-23	X, I, 23-25
Anal fin	II, 8-10	II, 10-11	II, 10-12	II, 12-13	I-II, 7-8	I-II, 7-8 (rarely 9)	II, 7-9	II, 5-7	II, 8 (occassionally 7)
Vertebrae	10+14-15	14-15+10	14-15+10	10+14-15	10+14-15	10+14-15	8-10+15-16 (usually 25 total)	10+14	10+14-15



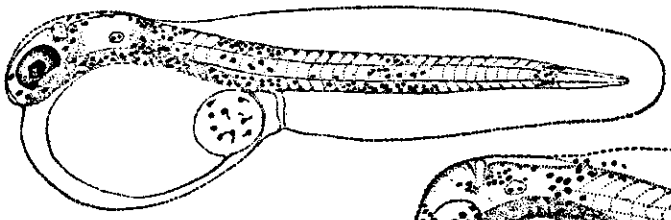
Blastodisc



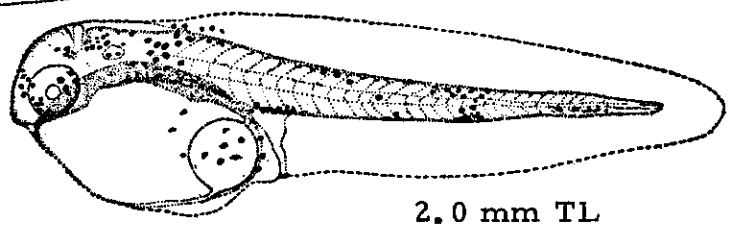
Early embryo



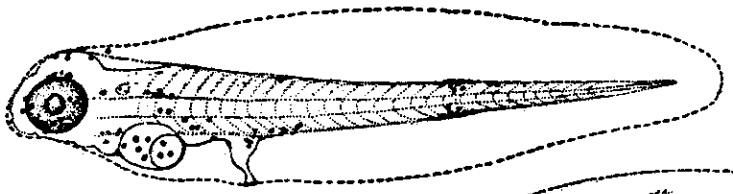
Late embryo



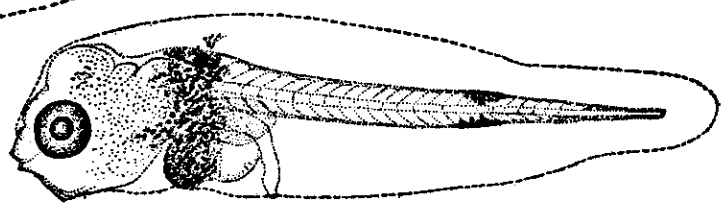
1.8 mm TL



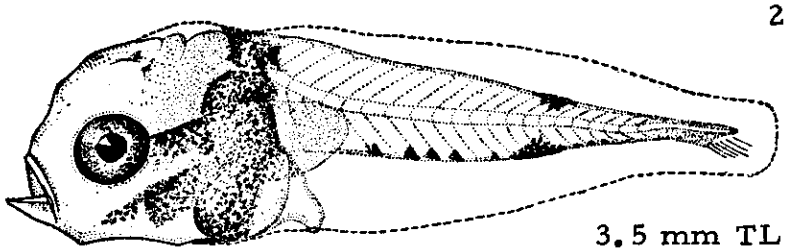
2.0 mm TL



2.5 mm TL



2.6 mm TL

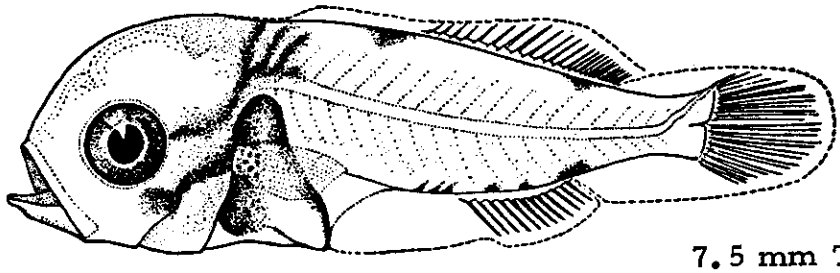


3.5 mm TL

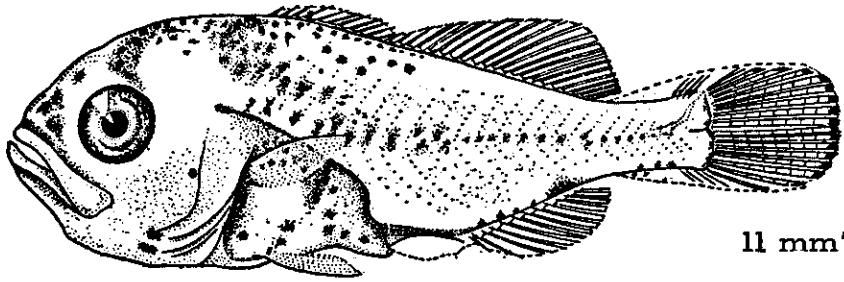
Spawning: Lower Chesapeake Bay and offshore along continental shelf.
Dates: May to August.
Temperature: 27-28 C (Beaufort, N.C.)

Eggs: Pelagic, spherical.
Size: Ca. 0.66-0.88 mm.
Characteristics: Mature unfertilized egg slightly yellowish; 1-2 oil globules at opposite pole from blastodisc which coalesce with development. Fertilized egg nearly transparent with thin horny membrane; barely perceptible perivitelline space; dorso-lateral areas of embryo and oil globules with yellow chromatophores.

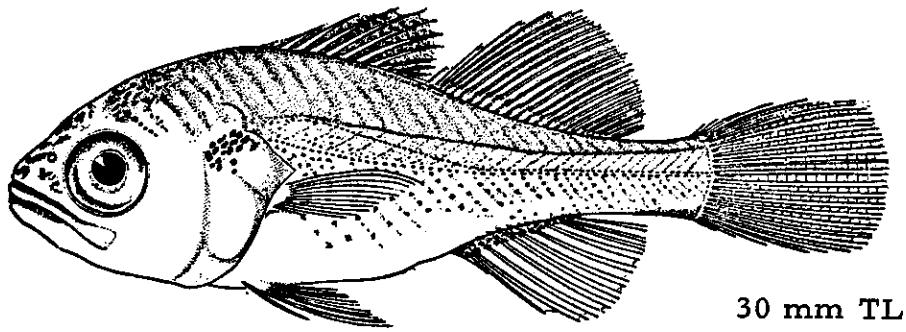
Bairdiella chrysura - silver perch



7.5 mm TL



11 mmTL



30 mm TL

Larvae: Hatching size: Ca. 1.5-1.8 mm TL.

Characteristics: Oil globule with scattered yellow chromatophores located at posterior end of yolk sac, yellow chromatophores aggregated forming vertical bands which break up with advanced development.

At 2.5-2.8 mm, yolk essentially absorbed; two vertical bands of yellow chromatophores present, one prominent band just behind head and another indistinct band ca. 2/3 the distance from vent to tail. After ca. 3.5 mm, vertical bands consist of melanophores which separate into dorsal and ventral blotches, with one large melanophore posterior to anal fin. Dorsal fin forming and pigmented at ca. 4.7 mm. By ca. 5.0 mm, tip of notochord turned upwards, general body color silvery gray.

Juveniles: Begin to assume adult characteristics at ca. 7.8 mm. At ca. 10-12 mm all fins present and at least partially developed, and by ca. 30 mm the juveniles are miniature adults.

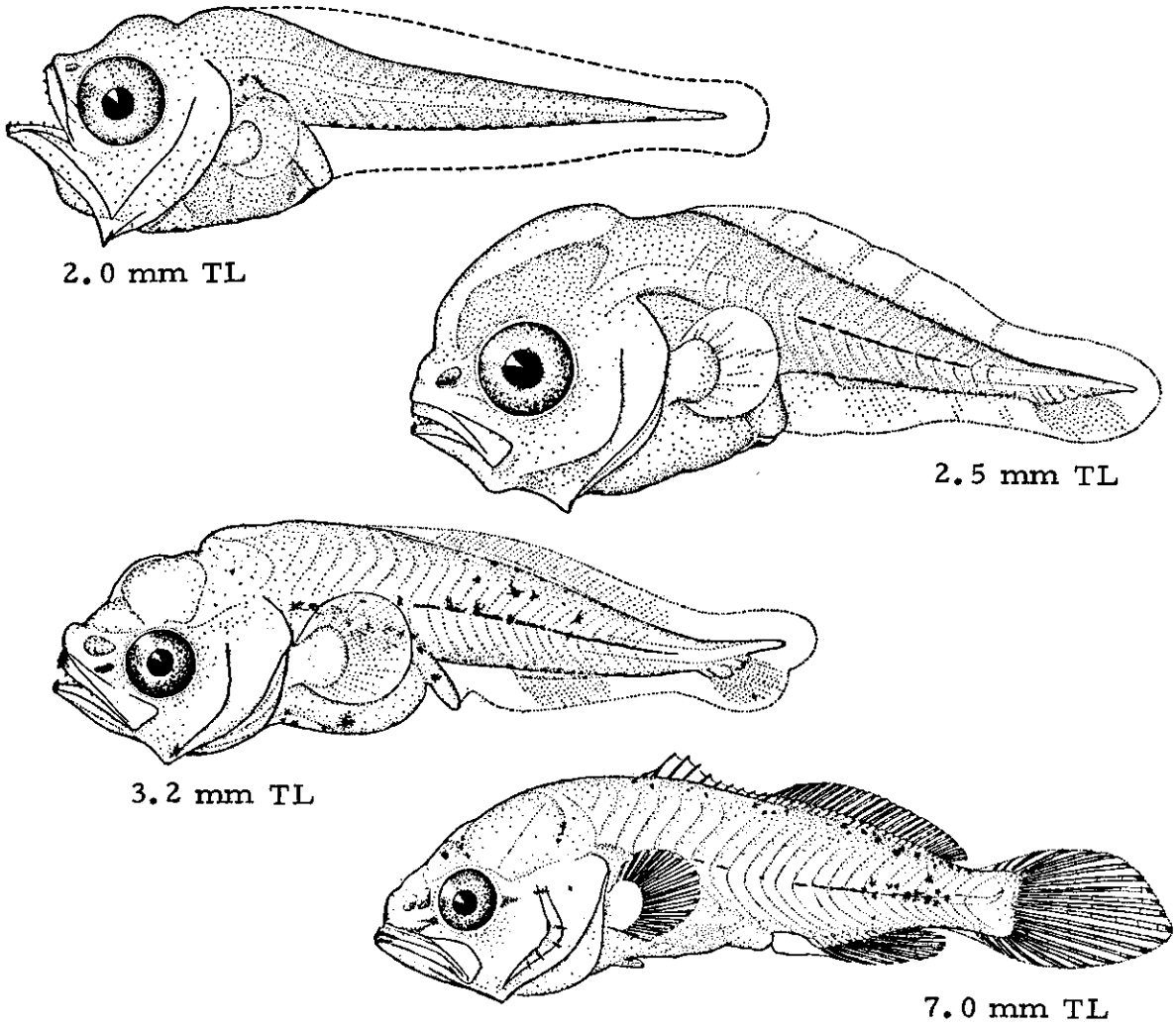
Adults: D. X-XI, I or II, 19-21 (20-23*); A. II, 8-10; abdominal vertebrae 10, caudal vertebrae 14-15; scales 55-59.

References: Hildebrand and Cable, 1930; Hildebrand and Schroeder, 1928;

Pearson, 1929; Welsh and Breder, 1923; Hildebrand and Cable, 1934; Miller and Jorgensen, 1973; Kuntz, 1914b.
*Peter Berrien, 1974 Workshop.

Illustrations: Kuntz, 1914b.

Cynoscion nebulosus - spotted seatrout



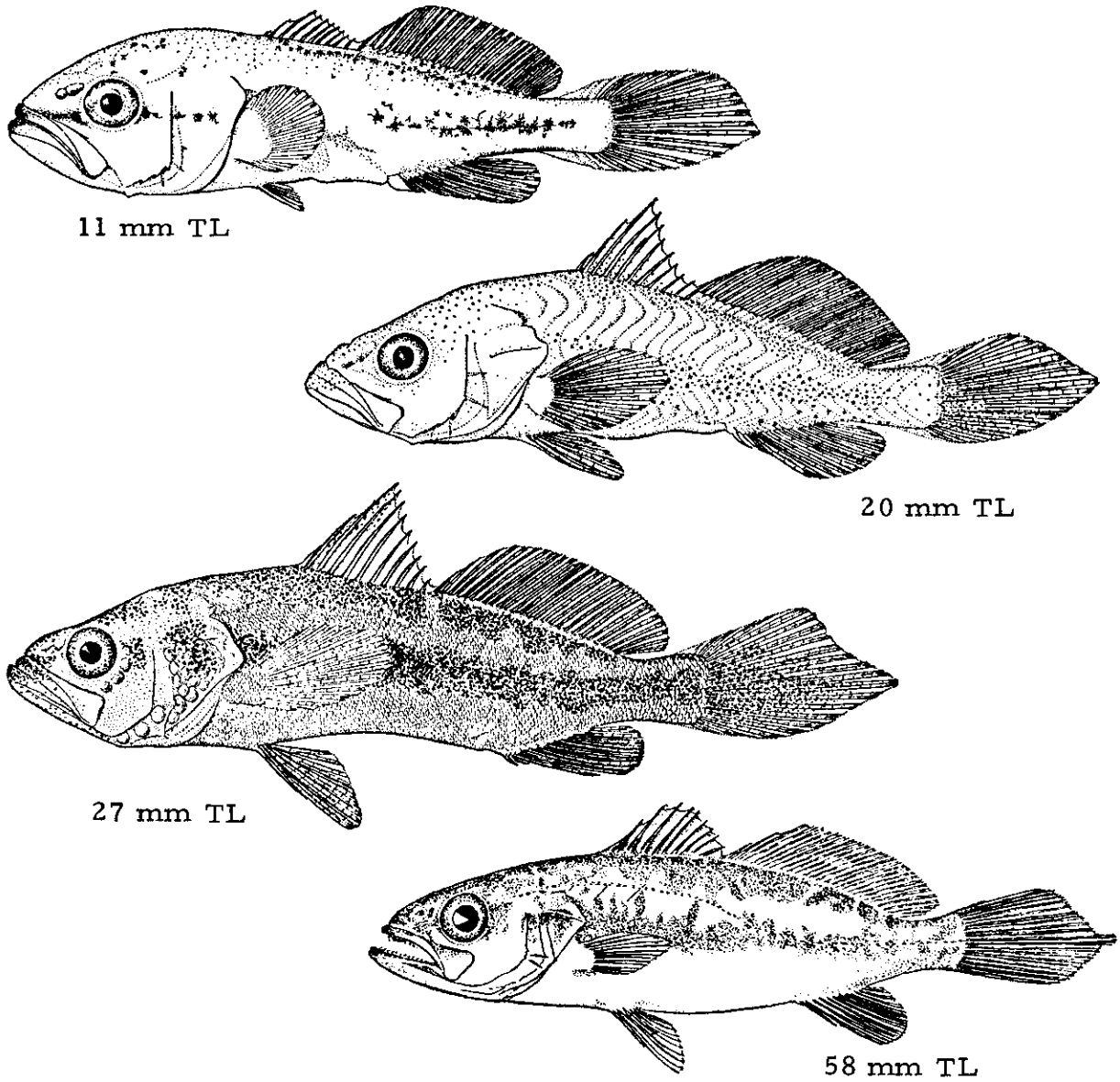
Spawning: Offshore along continental shelf and near mouth of Chesapeake Bay.
Dates: May to July, possibly to August.

Eggs: Unknown.

Larvae: Hatching size: Unknown.

Characteristics: At ca. 1.8 mm, deep head and trunk, slender tail, vent situated slightly in advance of mid-body length, mouth moderately large and strongly oblique, pectoral fins prominent, all other fins undifferentiated, dark blotch just anterior to vent, with a line of melanophores along anterior 2/3 of ventral surface of tail. Distinguished from weakfish, C. regalis, by deeper head and trunk, more slender tail and prominent and more closely spaced ventral melanophores.

At ca. 2.5 mm, vent situated exactly at mid-body length, primitive bases of anal and caudal present. Distinguished from weakfish at this size by lateral stripe of nearly connected black dashes, smaller melanophores along ventral outline of chest and abdomen, and by a less conspicuous spot anterior to vent.



At 3.0-3.6 mm, notochord turned upwards and ventral caudal rays present; dorsal and anal fins differentiating, no pelvic fins present; ragged black lateral stripe extends from shoulder almost to base of caudal, being faintly evident across opercle and snout; ventral melanophores of uniform size at base of anal fin (as opposed to the one enlarged melanophore at the posterior base of anal fin in weakfish).

By ca. 7.0 mm, snout pointed and longer than eye, definite black band present on snout anterior to eye and indefinitely along opercle posterior to eye, upper and lower lips dark, small dusky spots over head and along back and sides, caudal beginning to elongate. From 10 to 12 mm, melanophores increase in intensity and caudal less sharply pointed than in weakfish.

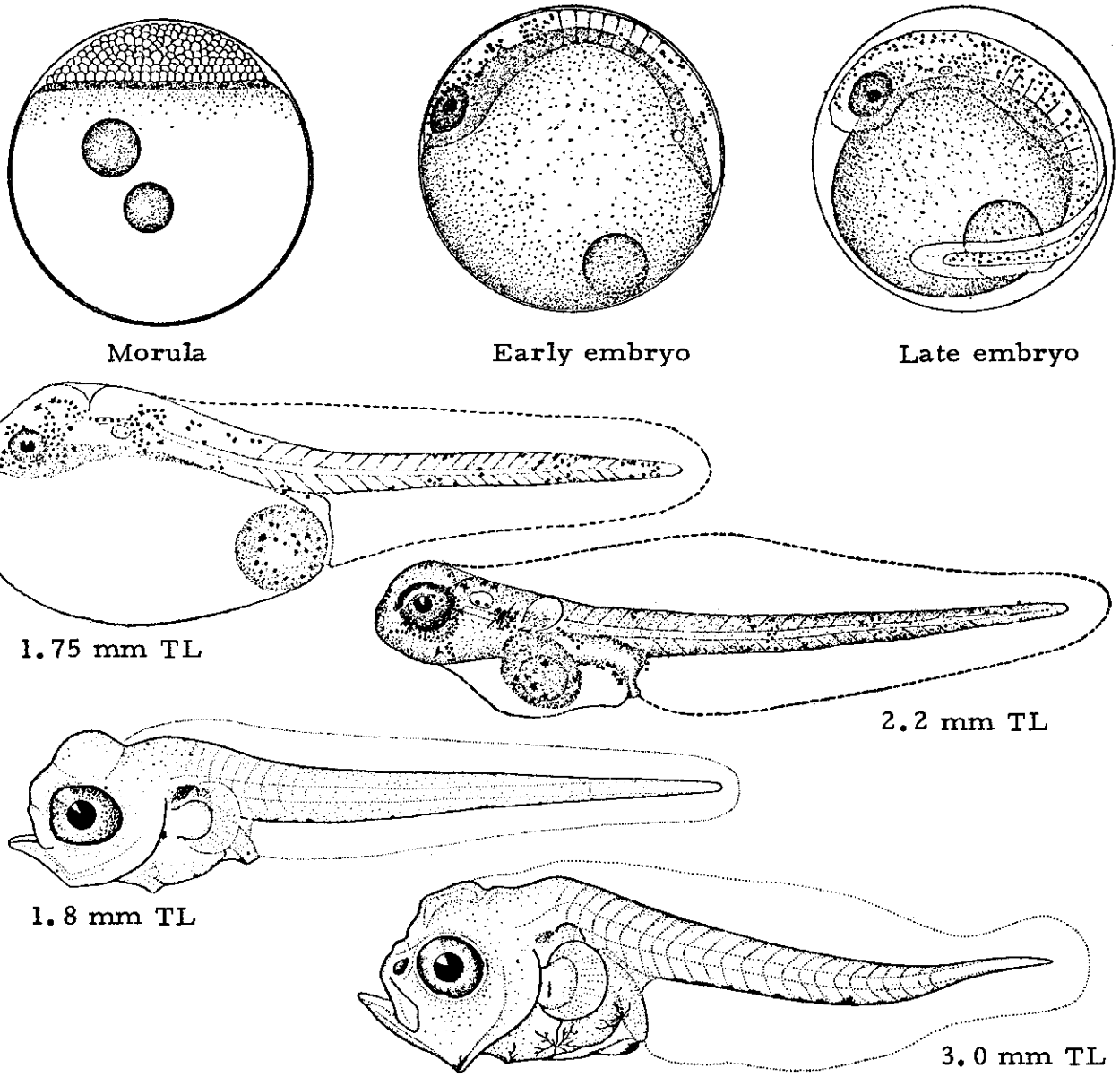
Juveniles: At ca. 16.0 mm, assume general adult characteristics, lower jaw projects strongly beyond upper; broad dark band along lateral line with dark blotches on back and at base of caudal (weakfish

with broad dark vertical bands); soft dorsal and anal fins scaleless.

Adults: D. X (rarely XI) I, 24-27; A. II, 10-11; abdominal vertebrae 14-15; caudal vertebrae 10; scales small, 90-100, 11-12 in a line from origin of anal fin to lateral line; body with round black spots.

References: Hildebrand and Schroeder, 1928; Miller and Jorgensen, 1973; Pearson, 1929; Welsh and Breder, 1923; Hildebrand and Cable, 1934.

Illustrations: Larvae, 20 and 27 mm juveniles, Hildebrand and Cable, 1934; 58 mm juvenile, Welsh and Breder, 1923.

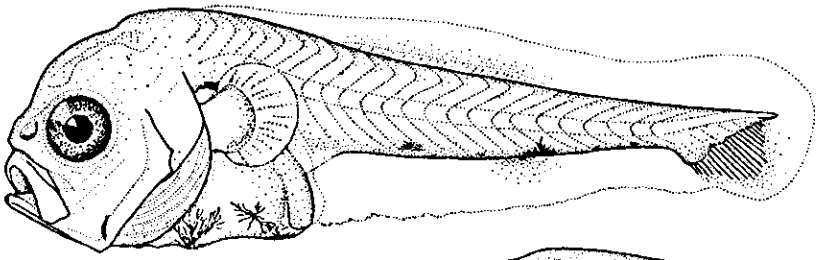


Larvae are taken in surface tows in the lower Bay until ca. 10-11 mm TL when they assume a demersal existence in muddy coves and creeks. Small yolk-sac larvae will probably not be taken in the Potomac River although older larvae and juveniles could be picked up in seines and trawls in late summer and fall.

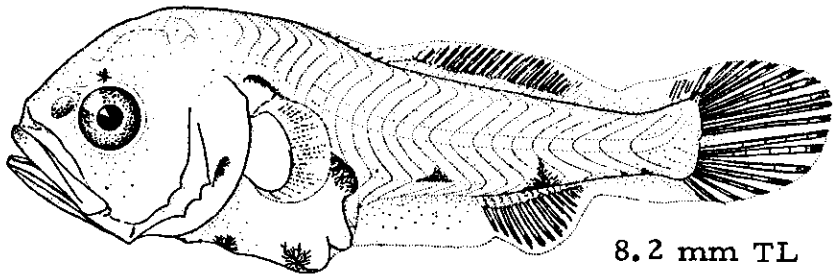
Spawning: Lower Chesapeake Bay and along Atlantic coast.
Dates: May to September (primarily in June and July).
Temperature: 15.5-21.0 C.
Salinity: 28.0-30.9 ppt.

Eggs: Pelagic and highly buoyant.
Size: Ca. 0.74-1.3 mm.
Characteristics: Spherical, transparent with thin horny membrane and 1-4 (rarely 5 or 6) amber oil globules in yolk which coalesce with development, very thin perivitelline space (narrower than in eggs of the silver perch, B. chrysura).

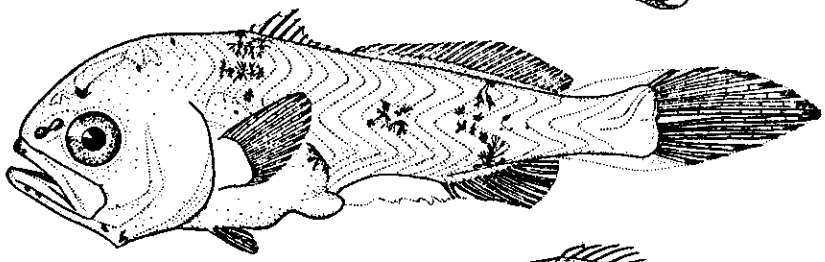
Cynoscion regalis - weakfish



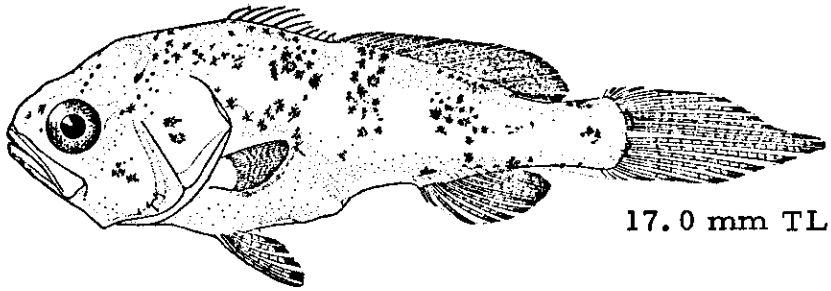
4.6 mm TL



8.2 mm TL



10.5 mm TL



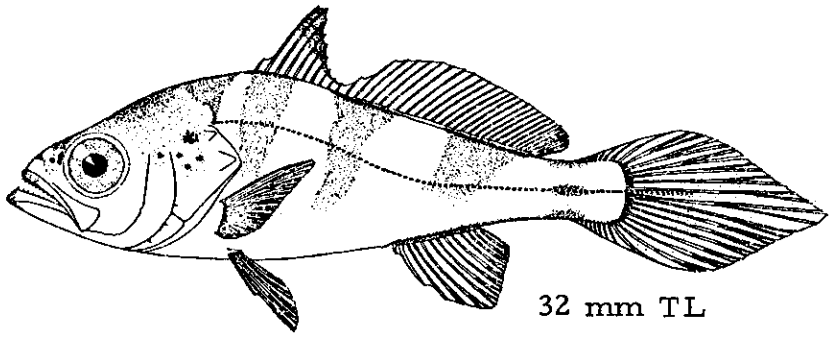
17.0 mm TL

Larvae: Hatching size: Ca. 1.5-1.75 mm TL.

Characteristics: Yolk usually absorbed at ca. 1.8 mm, large gaping mouth, elongated slender body (less deep anteriorly than in spotted sea trout, C. nebulosus), series of melanophores along ventral surface from vent to tail with one pronounced spot at base of primitive anal fin. A specimen of 2.2 mm; 24 hours after hatching (Welsh and Breder, 1923) still retained yolk. This variability can be attributed to differences in developmental rates between laboratory reared and field collected specimens.. At 3.0 mm, body depth increased, melanophores more prominent, especially anterior to vent and at base of anal fin, minute teeth at this stage distinguish weakfish from silver perch and Atlantic croaker, M. undulatus.

At ca. 4.6 mm, soft rays of all fins apparent. Distinguishable from spotted sea trout of same size by relative lack of body pigmentation except for prominent spot anterior to vent and melanophores along gut.

At 8.2 mm, snout noticeably more blunt than in spotted sea trout and lower jaw does not project noticeably beyond upper; all fins but pelvic formed. By 10.5 mm, melanophores present along lateral line and upper lip; caudal fin centrally elongate; dorsal fins almost complete.



32 mm TL

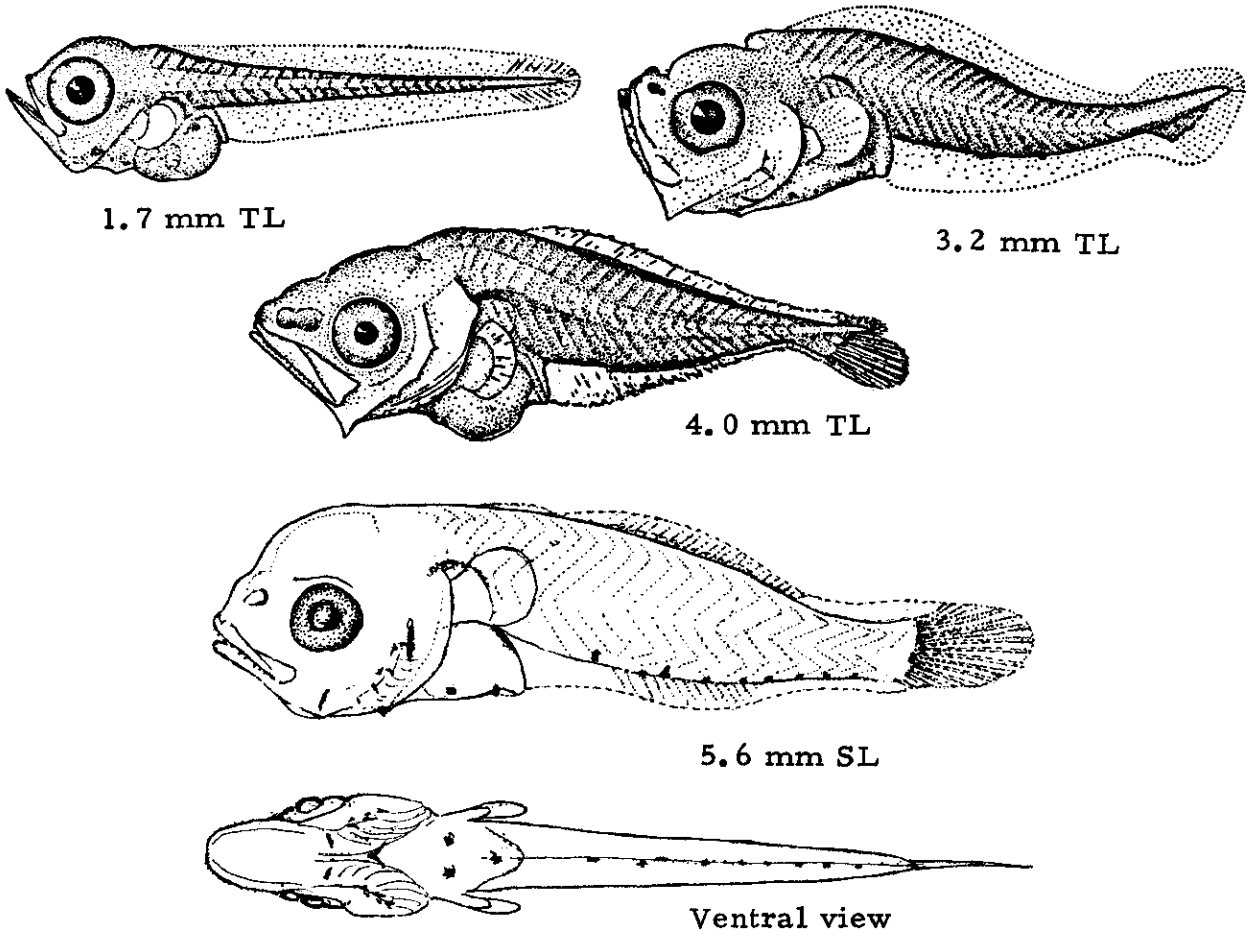
Juveniles: Tail pointed at 32 mm, ca. 4 lateral bands or saddles of pigmentation along back and sides (amount and intensity varies with environment), prominent anal melanophore gone. After 170 mm, body progressively longer and more slender, caudal becoming less pointed.

Adults: D. X-XI, I, 24-29; A. II, 10-12; abdominal vertebrae 14-15; caudal vertebrae 10; soft dorsal and anal fin usually closely scaled; body without black dots but with irregular dark blotches usually forming wavy, oblique lines; 11 or 12 scales in line between origin of anal fin and lateral line, caudal fin concave in adults.

References: Hildebrand and Cable, 1934; Hildebrand and Schroeder, 1928; Miller and Jorgensen, 1973; Pearson, 1950; Scotton, et al., 1973; Welsh and Breder, 1923.

Illustrations: Eggs, yolk-sac larvae, juvenile, Welsh and Breder, 1923; larvae, Pearson, 1950.

Leiostomus xanthurus - spot



Spot and Atlantic croaker, M. undulatus, are often taken simultaneously in plankton tows.

Spawning: Offshore along Atlantic coast, possibly mouth of Chesapeake Bay. Dates: Late winter and early spring (primarily April and May in Chesapeake).

Eggs: Unknown.

Larvae: Hatching Size: Ca. 1.5 mm TL.

Characteristics: Yolk sac absorbed at hatching; pigmentation closely resembles that of M. undulatus (which spawns in the fall and early winter) with very few or no melanophores on head, 2 or 3 each on region of anal and caudal fin bases, a concentration above air bladder, which appears as a dark crescent throughout larval stages, and an identifying dark blotch anterior to gut cavity between the two cleithral bones. At 2.8 mm mouth oblique, almost vertical; anterior portion of body rather deep with prominent hump over eyes and at shoulder; finfold undifferentiated. By ca. 3.6 mm, incipient rays in ventral caudal fin formed, mouth less strongly oblique, melanophores at hinge of mandible and few scattered over head. Tail has rounded appearance by ca. 4.0 mm, humps at head and shoulder disappear.